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Compliance by believing: an experimental exploration on social norms and impartial agreements.

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Abstract

The main contribution of this paper is twofold. First of all, it focuses on the decisional process that leads to the creation of a social norm. Secondly, it analyses the mechanisms through which subjects conform their behaviour to the norm. In particular, our aim is to study the role and the nature of Normative and Empirical Expectations and their influence on people's decisions. The tool is the Exclusion Game, a sort of 'triple mini-dictator game'. It represents a situation where 3 subjects – players A - have to decide how to allocate a sum S among themselves and a fourth subject - player B - who has no decisional power. The experiment consists of three treatments. In the Baseline Treatment participants are randomly distributed in groups of four players and play the Exclusion Game. In the Agreement Treatment in each group participants are invited to vote for a specific non-binding allocation rule before playing the Exclusion Game. In the Outsider Treatment, after the voting procedure and before playing the Exclusion Game, a player A for each group (the outsider) is reassigned to a different group and instructed about the rule chosen by the new group. In all the treatments, at the end of the game and before players are informed about the decisions taken during the Exclusion Game by the other co-players, first order and second order expectations (both normative and empirical) are elicited through a brief questionnaire. The first result we obtained is that subjects' choices are in line with their empirical (not normative) expectations. The second result is that even a non-binding agreement induces convergence of empirical expectations – and, consequently, of choices. The third results is that expectation of conformity is higher in the partner protocol. This implies that a single outsider breaks the 'trust and cooperation' equilibrium.

Keywords: fairness, social norms, beliefs, psychological games, experimental games.

JEL Classification: C72, C91, A13.

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Introduction

In the fields of experimental economics and behavioural game theory one of the most studied topic is subjects' reaction when a cooperation norm or a redistribution norm is violated. This implies that the experimental literature concerning norms mainly corresponds to studies on norms of fairness and, consequently, on punishment of defectors (f.i., Fehr and Gächter, 2000, for second-party punishment; Fehr and Fischbacher, 2004, for third-party punishment). A further implication of these studies is that updating the classical figure of the *Homo Oeconomicus* by introducing more sophisticated preferences (inequity aversion, reciprocity, altruism, spitefulness, and so on[1]) into the economic theories is sufficient to explain the experimental results.

Mostly unexplored, both at the empirical and at the theoretical level, is the issue of compliance with norms prescribing non-selfish choices in contexts in which i) sanctions (or rewards) can not be implemented; ii) reputational mechanisms and endogenous sanctions can not be effective, due to ex-post non-verifiability or simply to the fact that the game is one shot.

As shown by Faillo and Sacconi (2007), in these cases theories of social preferences and reciprocity fail in explaining the decision to comply with the norm. A contribution in dealing with this issue comes from non-consequentialist theories, like the ones devised by Sacconi and Grimalda (2007)[2] and Bicchieri (2006). A common assumption of these theories is that in a strategic interaction amongst *N* players, player *i's* decision to comply with a shared norm, which dictates a choice in contrast with her material self-interest, depends on her beliefs about other *N-1* players' willingness to comply (conditional compliance hypothesis).

Sacconi and Grimalda (2007) develop a model of conformist preferences based on psychological game theory. According to this model, a player characterized by conformist preferences complies if she participates in choosing the norm in a social contract setting, she expects that other players

[1] See Fehr and Schmidt (2000), Camerer (2003).
[2] See also Grimalda and Sacconi (2005).

who have contributed to choose the rule will comply (First Order Empirical Expectations) and she expect that others will expect that she will comply (Second Order Empirical Expectations). Experimental evidence compatible with this model has been collected by Sacconi and Faillo (2005) who show that the introduction of a non-binding agreement on a division rule influences individual expectations and choice. In particular, they observe that for a significant number of subjects the agreement seems to represent a sufficient condition to expect reciprocal conformity and therefore to conform to the rule.
Bicchieri (2006) devises a theory according to which compliance is observed when the player is aware of existence of the norm, she believes that a sufficiently large number of people comply with the norm (First Order Empirical Expectations); *and* either a sufficiently large number of people think that she ought to conform *or* a sufficiently large number of people are ready to sanction her for not conforming (Second Order Normative Expectations). Bicchieri and Xiao (2007) run an experiment in which they show that when normative expectations (what we believe others think ought to be done) and empirical expectations (what we expect others actually do) are in contrast, subjects choose according to the latter[3].

In our paper we give a closer look at the relation between individual expectations and the decision to comply with a norm. We consider the case of a non-binding norm that is chosen through an agreement amongst agents who vote behind a veil of ignorance, and who interact in a one-shot game in which they decide whether to comply or not with the rule.
We investigate on four types of expectations of a generic player *i*:
First Order Empirical Expectations (FOEE): player *i*'s beliefs about other players' choice.
Second Order Empirical Expectations (FOEE): player *i*'s beliefs about other players' beliefs about her choice.

[3] Further evidence on the role of empirical and normative expectations in fostering compliance with norms of fairness can be found in a recent paper by Krupka and Weber (2007).

First Order Normative Expectations (FONE): player *i*'s beliefs about what is the right choice in a particular situation.
Second Order Normative Expectations (SONE): player *i*'s beliefs about what other players consider as the right choice in a particular situation.

Our objective is to study how these different types of expectations contribute in explaining the decision to comply with a shared norm. We consider a simple game, and we start by studying the relationship between choice and expectations. To do this we observe how subjects play the game and we collect data on what they believe others will do and expect. We add then an analysis of how the introduction (before the actual play of the game) of an agreement on a non-binding division rule influences subjects' expectations, and consequently the way in which the game is played. Finally, we consider the case in which subjects play the game with co-players who are not those with whom they participated in the agreement.

As it will become clearer in the following pages, these steps correspond to the three treatments of our experimental design: the *Baseline Treatment* (BT), the *Agreement Treatment* (AT), and the *Outsider Treatment* (OT). The BT gives us general information about the relationship between choice and empirical and normative expectations. The comparison between what we observe in BT and AT allows us to examine the influence of the agreement on expectations and choice. Finally by comparing the AT with OT we can assess the importance of actual participation in the agreement for the decision to comply with the norm.

The paper is organized as follows: experimental design, procedure and hypotheses are presented in Section 2; results are analyzed in Section 3; discussion of the results and some conclusive remarks end the paper (Section 4).

2. Experimental Design

The tool is the *Exclusion Game* (Sacconi and Faillo, 2005; Faillo and Sacconi, 2007), a sort of 'triple mini-dictator game'. It represents a situation where 3 subjects – players A - have to decide how to allocate a sum S among themselves and a fourth subject - player B - who has no decisional power. In particular, each player A has to decide the amount she wants to ask for herself choosing one of three possible strategies: asking 25%, 30% or 33% of S. The payoff of players A is exactly the sum asked for themselves (a1, a2 and a3 respectively), while the payoff of player B is the remaining sum (S – a1 – a2 – a3). In our experiment, each group is give 60 tokens – each token corresponds to € 0,50 - and each player A's strategies are : "Ask for 15 tokens", "Ask for 18 tokens", "Ask for 20 tokens".

The experiment consists of three treatments: the *Baseline Treatment* (*BT*), the *Agreement Treatment (AT)* and the *Outsider Treatment (OT)*.

In the *BT* participants are randomly distributed in groups of four players and play the *Exclusion Game*.

In the *AT* participants are randomly distributed in groups of four players and are instructed about the stages of the experiment and about the *Exclusion Game*. In the first stage, before knowing their role in the game, they are involved in a voting procedure. In each group participants are invited to vote for a specific allocation rule. In particular, subjects must vote one out of three alternative division rules (the forth number is player B's payoff): {15,15, 15,15},{18,18, 18,6}, {20,20, 20,0}. The first rule assigns the same payoff to every member of the group; the second rule corresponds to a partial inclusion of player B in sharing the wealth; the third rule implies the total exclusion of player B. Players must reach a unanimous agreement on the rule within a limited numbers of trials (10 in our experiment). The voting is computerized and completely anonymous. The agreement is not binding, but failure in reaching it is costly, since only groups who reach an agreement in this first stage have the chance to participate to the second stage. In the second stage the

composition of the groups is unchanged and roles are randomly assigned to implement the *Exclusion Game*. In this case, players A can decide either to implement the voted rule or to choose one of the alternative allocations. Players who do not enter the second stage wait for the end of the session. Their payoff is the show-up fee.

In the *OT* participants are randomly distributed in groups of four players and are instructed about the stages of the experiment and about the *Exclusion Game*. The first stage as well as the rule to enter the second stage are the same as in the *AT.* At the beginning of the second stage, players are informed about their role and groups are rematched. In particular, a player A for each group (the outsider) is reassigned to a different group and instructed about the rule chosen by the new group, while the other members of the group ignore the rule she voted for in her previous group. After the re-matching, subjects participate in the *Exclusion Game.* Also in this case players who do not enter the second stage wait for the end of the session and they are paid only the show-up fee.

For a summary see Figure 1.

2.1 Experimental Procedure.

The experiment was run both in Milan (EELAB – University of Milan Bicocca) and in Trento (CEEL – University of Trento) [4]. We ran 3 sessions for the *BT* (1 in Milan and 2 in Trento), 4 sessions for the *AT* (2 in Milan and 2 in Trento), 5 sessions for the *OT* (3 in Milan and 2 in Trento). Overall, 216 undergraduate students – 104 in Milan and 112 in Trento – participated in the experiment. A more detailed description of the sessions is in Table 1.

[4] At University of Trento subjects were recruited by posting ads at various departments. Ads were posted one week before the experiment. Subscriptions by students interested in participating in the experiment have been collected by the staff of the Computable and Experimental Economics Laboratory (CEEL) of the University of Trento.
At University of Milano-Bicocca subjects were recruited by email. They were students included in the mailing list of the Experimental Economics Laboratory of the University of Milano-Bicocca (EELAB). Two weeks before the experiment they received an email in which the staff invited them to visit the Laboratory's website for information about the experiment and subscriptions.

The experiment was programmed and conducted with the software z-Tree (Fischbacher, 2007). The instructions were read by participants on their computer screen while an experimenter read them loudly.

After reading the instructions and before subjects were invited to take decisions, some control questions were asked in order to be sure that players understood the rules of the game. At the end of each session, subjects were asked to fill in a brief survey to check for socio – demographic data.

Players were given a show – up fee of 3 euro.

2.2 Beliefs elicitation.

In all the treatments, at the end of the game and before players were informed about the decisions taken during the *Exclusion Game* by the other co-players, first order and second order expectations (both normative and empirical) were elicited through a brief questionnaire. In particular, in each group each player made a statement:

1. of the probabilities related to each possible choice of co-players A (First Order Empirical Expectations);

2. of the probability related to each co-players' possible judgement about her own choice (Second Order Empirical Expectations);

3. of the choice should have been taken by a representative player A (First Order Normative Expectations) ;

4. of the choice that co-players consider as the 'right' one (Second Order Normative Expectations) [5].

Both in the *AT* and in the *OT* only players who entered the second stage were interviewed about their expectations. Moreover, in the *OT* guesses on behaviour and beliefs of partners and outsiders were asked separately.

Only good guesses of the Empirical Expectations were rewarded through a quadratic scoring rule (Davis and Holt, 1993) [6].

2.3 Experimental Hypotheses.

Hypothesis 1 (H1): According to psychological game theory models[7], individual preferences depend on their expectations (of different orders and nature). Consequently, individuals' choices in the *Exclusion Game* could be explained in terms of their expectations about others' behaviour. Moreover, if Bicchieri and Xiao (2007) are right, when normative and empirical expectations are in contrast, the latter play a more relevant role in players' decisional process.

Hypothesis 2 (H2): In treatments AT and OT agreement should be reached by all the groups since it is not binding but its failure is costly (failure would prevent them to enter the second stage of the experiment).

Hypothesis 3 (H3): According to both conformist preferences and Bicchieri's theories, the possibility of agreeing with a distributive norm enhances compliance by inducing a convergence of individual expectations. In other words, compliance can be explained in terms of emergence of reciprocal expectations of conformity due to the agreement.

Hypothesis 3a (H3a): According to Bicchieri's theory, subjects will comply if i) they believe that other members of their group will comply (First Order Empirical Expectations compatible with the choice dictated by the rule) *and* if ii) they believe that other members of the group think that complying is the right thing to do (Second Order Normative Expectations compatible with the choice dictated by the rule).

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[5] See appendix 1 for details on the belief elicitation procedure.

[6] We used the scoring rule:

$$Q(p) = a - b\sum_{k=1}^{N}(I_k - p_k)^2$$

Where I_k takes value 1 if the realized event is the event k and 0 otherwise. p_k is the probability associated with event k. The maximum score is a, and the minimum score is a-$2b$. We chose $a=2$ e $b=1$.

[7] See for example Geanakoplos et al. (1989); Rabin, (1993).

Hypothesis 3b (H3b): According to Sacconi and Grimalda, subjects will comply if i) they participate in the agreement on the rule, ii) they believe that other members of their group will comply (First Order Empirical Expectations compatible with the choice dictated by the rule) *and* if iii) they believe that other members of the group expect they will comply (Second Order Empirical Expectations compatible with the choice dictated by the rule).

3. Data analysis

In this section we want to give an overview of our experimental data and results by discussing two main points. Firstly, we want to analyse the relation between beliefs and behaviour. In particular, we want to check whether beliefs influence subjects' decisional process. Secondly, we want to test whether and how different scenarios influence beliefs and, consequently, people's decisions.

3.1 Description

Overall, 216 undergraduate students participated in the experiment. 56 players were recruited for the BT, 72 for the AT and 88 for the OT. We have observations of 42 subjects A in the BT, 54 in the AT and 66 in the OT.

In the BT, players A mostly chose to ask the highest amount of tokens (20) – 73.8% against 21.4% who choose 18 and 4.8% who chose 15. Both in the AT and in the OT the situation is different. In the AT, 37% , 16.7% and 46.3% chose respectively 20, 18 and 15. In the OT the percentages are 54.5%, 12.1% and 33.4%.

Concerning the voted rule, the 15-15-15-15 one seems to be the preferred option both in the AT and in the OT. In particular, 17 groups out of 18 in the AT and 20 out of 22 in the OT chose the fair-division rule. The 18-18-18-6 rule has been chosen by 2 groups in the AT, while only 1 group in the OT chose the 20-20-20-0 rule. 50% of players in the AT and 39.4% in the OT complied to the voted rule when playing the *Exclusion Game*.

3.2 Results

Result 1. Subjects' choices are in line with their expectations.

If we check whether there is any correlation between beliefs and decisions, it turns out that most players' choices are in line with either empirical or normative expectations (Table 2)[8]

However - as in Bicchieri and Xiao (2007) - when normative and empirical expectations are in contrast, the latter play a more relevant role in players' decisional process (Table 3) and they are significantly correlated to subjects' choices (Spearman test; $p < 0.03$). This is not the case when we analyse normative expectations (Spearman test; $p > 0.17$).[9]

Result 2. When agreement is possible, it is reached by all groups.

As we expected, when agreement is possible, it is reached by all groups. This is a quite obvious result: agreement is not binding but a failure in reaching it is expensive. However, the real interesting point is the fact that the fair rule 15-15-15-15 seems to be a sort of focal point (see Table 4). What does it mean? Let us look at the results of the first voting attempt. From Table 5 it emerges that 75% of players in the AT and 70% of players in the OT indicate as their first choice the 15-15-15-15 rule. If we run a binomial test (choosing the 15-15-15-15 rule against choosing another rule) it turns out that these values are significant ($p = 0.000$ in the AT and $p = 0.04$ in the OT). This may imply that most of people perfectly know what is right. However, what happens to the remaining 25% and 30%? Why do most of them convert themselves? And why do, when playing the *Exclusion Game,* the 50% of subjects in the AT and the 61% in the OT decide not to comply with the rule (Table 6)? A possible explanation is that 'unfair' subjects vote for the non-binding 'fair' rule in order to end the time-consuming voting procedure. However, this is not enough for players who prefer the 'fair' rule. They perfectly know that the agreement is not binding (in fact, among players who eventually vote for a rule different

[8] We consider only first order expectations since second order expectations are either equal or highly correlated to the former. For a more detailed description, see Appendix 1.

[9] Test run only on observations where FONE and FOEE are different.

from their first choice, 71% do not comply when playing the *Exclusion Game*) and if they think that the other co-players do not comply, probably they will defect as well. This would be in line both with the fact that empirical expectation are more relevant than normative ones and with the higher probability of expecting the others will choose 20 (at least in the AT) as soon as the number of voting rounds increases (see Appendix 2).

Result 3. Agreement induces convergence of empirical expectations.

In the BT at least 70% of the players ask 20, while in the AT only 37% of the participants ask for the maximum. This difference is significant (Mann-Whitney[10]; $p = 0.0002$). However, our experimental hypothesis is more complicated and implies a two-step reasoning process of our participants. Step 1: the agreement influences players' empirical expectations. Step 2: empirical expectations define subjects' choices. This means that we want to show that the difference between BT and AT is a consequence of the impact of the agreement on players' beliefs and preferences.

In the AT 17 groups out of 18 choose the 15-15-15-15 rule and 1 the 18-18-18-6 one. If we analyse people's expectations, it turns out that in the AT there is a significant decrease of subjects who think that the other members of their group have asked for 20 tokens (Table 7). A probit regression – where the dependent variable is the probability of expecting the others have chosen 20 – shows that subjects' are more likely to expect a selfish behaviour of the co-players in the BT ($p = 0.000$). A bivariate recursive probit confirms both beliefs' influence on subjects' decisions ($p = 0.00$) and the convergence of empirical expectations toward a choice in line with the fair rule ($p = 0.000$).[11] More details on the econometric analysis in Appendix 2.

Result 4. Expectation of conformity is higher in the partner protocol.

[10] Independent observations are average choices of each group in order to take account of the fact that choices within the same group in the AT are not independent.

[11] This result is perfectly in line with the result obtained by Sacconi and Faillo (2005) through a within-subject design.

When we introduce a mixed protocol in which the *Exclusion Game* is played in groups where one subject is an 'outsider' (in the OT), a lower percentage of players comply to the chosen rule (Table 6). Again, our experimental hypothesis implies a two-step reasoning process of our participants. Step 1: the introduction of an outsider influences players' empirical expectations. Step 2: empirical expectations define subjects' choices. This means that, once again, we want to show that the difference between AT and OT is a consequence of the impact of the outsider on players' beliefs. If we analyse people's expectations, it turns out that in the AT players believe in co-players' compliance more than in the OT (Table 8). A probit regression – where the dependent variable is the probability of expecting the others to comply – shows that subjects are more likely to expect compliance in the AT (p = 0.046). A bivariate recursive probit confirms both beliefs' influence on subjects' decisions (p = 0.012) and the fact that in the OT subjects are more likely to expect co-players' deviation from the chosen rule. (p = 0.051). More details on the econometric analysis in Appendix 2.

Result 5. Sacconi and Grimalda predict our players' behaviour while Bicchieri's theory seems to be less robust.

The previous analyses confirms the robustness of Sacconi and Grimalda's theory. According to them FOEE and SOEE should be compatible with the choice dictated by the rule. In our data, SOEE are in line with FOEE (see result 1). Moreover, FOEE influence subjects' decisions (see result 3 and result 4), and participation in the agreement has a significant impact on the decision to comply (result 4.)

On the other hand, Bicchieri's theory seems to be less robust. According to Bicchieri, both FOEE and SONE in line with the chosen rule are necessary to predict compliance. To check this point we isolate the subgroup of subjects who comply to the chosen rule and whose FOEE are in line with it. We obtain a subgroup of 14 subjects in the AT and 14 subjects in the OT. If we analyse the correlation between SONE and choice it turns out that they are correlated neither in the AT (Spearman correlation coefficient; p = 0.23) nor among the

insiders in the OT (Spearman correlation coefficient; $p = 0.5$). They are only slightly correlated among the outsiders in the OT (Spearman correlation coefficient; $p = 0.07$), but in this case we have only 6 observations.

4. Conclusions

The aim of this paper is twofold. First of all, it focuses on the decisional process that leads to the creation of a social norm. Secondly, it analyses the mechanisms through which subjects conform their behaviour to the norm.

We can summarize our results by saying that:

1) subjects' choices are in line with their empirical expectations, and when normative and empirical expectations are in contrast, the latter play a more relevant role in players' decisions (H1);
2) Agreement is reached in all groups (H2);
3) Even a non-binding agreement induces convergence of empirical expectations and, consequently, of choices (H3). Moreover, it confirms the robustness of the results obtained in Faillo and Sacconi (2007). In particular, it is perfectly in line with the hypothesis that subjects comply with a norm if they believe that other members of their group will comply and if they believe that other members of their groups expect they will comply (H3b);
4) the results of the OT treatment seems to suggest that participation in the agreement is a necessary condition for compliance. Insiders do not expect compliance from outsiders, and consequently they do not comply (H3b). Outsiders seem to acknowledge it, and, expecting non-compliance by the insiders, they do not comply.
5) the last result we obtain (a generally non significant correlation between SONE and choice of conformity) does not confirm the hypothesis that both first order empirical expectations and second order normative expectations are necessary conditions for compliance (H3a).

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Figure 1. Treatments

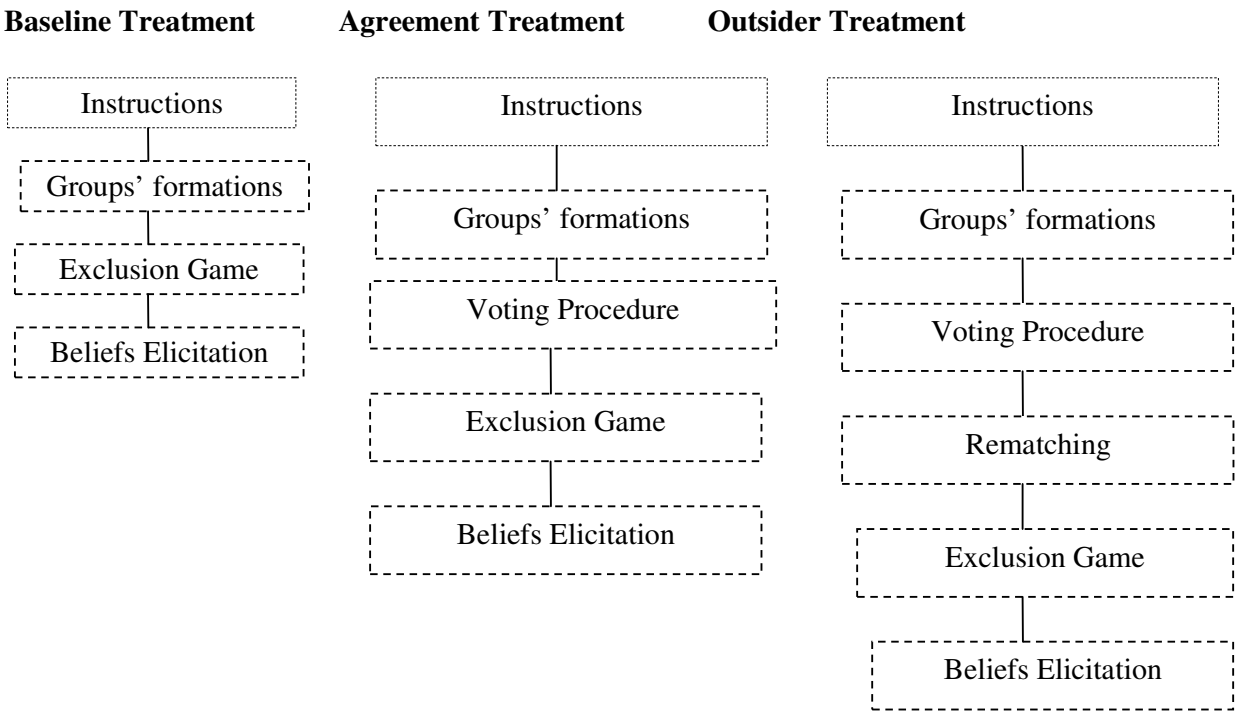

Table 1. Experimental Design

Treatment	Voting Procedure	Matching	Sessions	Subjects
BT	NO	Partner Protocol	2 in Trento (T) 1 in Milan (M)	36 (T) + 20 (M) 9 groups (T) + 5 groups (M) (27 (T) + 15 (M) players A)
AT	YES	Partner Protocol	2 in Trento (T) 2 in Milan (M)	36 (T) + 36 (M) 9 groups (T) + 9 groups (M) (27 (T) + 27 (M) players A)
OT	YES	Mixed – Partner and Stranger Protocol	2 in Trento (T) 3 in Milan (M)	32 (T) + 56 (M) 8 groups (T) + 14 groups (M) (24 (T) + 42 (M) players A)

Table 2. Beliefs and choices

	It is possible to explain subjects' behaviour through…		
	FOEE	FONE	OTHER
BT			
T (N = 27)	82%	7%	11%
M (N = 15)	93%	0%	7%
AT			
T (N = 27)	82%	11%	7%
M (N = 27)	82%	7%	11%
OT			
T (N = 24)	71%	21%	8%
M (N = 42)	83%	10%	7%

FOEE= First Order Empirical Expectation.
FONE= First Order Normative Expectations.

Table 3. Normative and empirical expectations

When FOEE and FONE are different it is possible to explain subjects' behaviour through…			
	FOEE	FONE	OTHER
BT T (N = 14) M (N = 8)	72% 100%	14% 0%	14% 0%
AT T (N = 11) M (N = 9)	64% 78%	27% 22%	9% 0%
OT T (N = 14) M (N = 21)	57% 71%	14% 19%	29% 10%

FOEE= First Order Empirical Expectation.
FONE= First Order Normative Expectations.

Table 4. Groups' Voted Rule by University x Treatment.

		Rule					
		15 – 15 – 15 – 15		18 – 18 – 18 – 6		20 – 20 – 20 – 0	
Trento	AT	88.9%	8/9	11.1%	1/9	0.0%	0/9
	OT	87.5%	7/8	12.5%	1/8	0.0%	0/8
Milano							
	AT	100.0%	9/9	0.0%	0/9	0.0%	0/9
	OT	92.9%	13/14	0.0%	0/14	7.1%	1/14

Table 5. First voted rule by Treatment.

	AT	OT
15-15-15-15	75% 54/72	70% 62/88
18-18-18-6 or 20-20-20-0	25% 18/72	30% 26/88

Table 6. Compliance by University x Treatment.

Trento	AT	44.4%	12/27 10 rule 15 - 2 rule 18
	OT	29.2%	7/24
	OT (Insiders)	37.5%	6/16 5 rule 15 - 1 rule 18
	OT (Outsiders)	12.5%	1/8 1 rule 15
Milano	AT	55.5%	15/27 15 rule 15
	OT	45.2%	19/42
	OT (Insiders)	39.3%	11/28 9 rule 15 - 2 rule 20
	OT (Outsiders)	57.1%	8/14 7 rule 15 - 1 rule 20

Table 7. Distribution of FOEE by University x Treatment

		15 - 18	20
Trento	BT (N = 27)	15.0%	85.0%
	AT (N = 27)	20.0%	80.0%
Milano	BT (N = 15)	52.0%	48.0%
	AT (N = 27)	69.0%	31.0%

Table 8. Expectation of Compliance by University x Treatment.

Trento	AT	40.7%	11/27
	OT	20.8%	5/24
Milano	AT	51.8%	14/27
	OT	30.9%	13/42

Appendix 1– The beliefs elicitation procedure

Data on subject's expectations have been collected through a questionnaire. We adopted two different questionnaires, one for the Baseline and the Agreement treatments and one for the Outsider treatment.

BASELINE TREATMENT AND AGREEMENT TREATMENT

Let us identify the three active members of the group (players A) as Ax, Ay and Az. The questions were exactly the same for the three players. By way of example we will take the point of view of player Ax.

1. <u>First Order Empirical Expectations (FOEE)</u>

"You are the participant Ax. According to you opinion, what is the probability (expressed in percentage terms) that Ay has made the following choices:

CHOICE	PROBABILITY
S/he asked for 15 tokens	[ ]
S/he asked for 18 tokens	[ ]
S/he asked for 20 tokens	[ ]

Remember that the three percentages must sum to 100%"

(We asked the subject if this probability would hold also for player Az. If not s/he could enter different values for Az. Thus, each subject answered to two questions on FOEE.)

<u>2. Second Order Empirical Expectations (SOEE)</u>

"You are the participant Ax. Now we ask you to assign a probability (expressed in percentage terms) to each of these hypotheses regarding the probabilities assigned to your choice by participant Ay

HYPOTHESIS	PROB.
According to Ay, my most probable choice has been to ask for 15 tokens	[ ]
According to Ay, my most probable choice has been to ask for 18 tokens	[ ]
According to Ay, my most probable choice has been to ask for 20 tokens	[ ]

According to Ay, all my three choices are almost equiprobable [ ]

According to Ay, only two of my three choices are almost equiprobable [ ]

Remember that the five percentages must sum to 100%"

(We asked the subject if this probability would hold also for player Az. If not s/he could enter different values for Az. In this ways each subject were submitted two question on FOEE.)

3 First Order Normative Expectations (FONE)

"Think of a generic participant A. What is the right number of tokens s/he should ask for?

I think the right number of tokens is 15 [ ]

I think the right number of tokens is 18 [ ]

I think the right number of tokens is 20 [ ] "

3 Second Order Normative Expectations (SONE)

"Think of a generic participant A. What do you think is her/his opinion with regard to the right number of tokens that a generic participant A should ask for?

I think s/he believe that the right number of tokens is 15. [ ]

I think s/he believe that the right number of tokens is 18 [ ]

I think s/he believe that the right number of tokens is 20 [ ] "

OUTSIDER TREATMENT

In this treatment we must distinguish between the members of the group who have voted the rule and are still in their original group and the Outsider (the subject who comes from a different group). Let us use "*Ax*" and "*Ay*" to identify the members who have not changed the group and "*AO*" to identify the outsider.

1. First Order Empirical Expectations (FOEE)

Questions for the Ax and Ay members

"You are the participant Ax (Ay). According to your opinion, what is the probability (expressed in percentage terms) that Ay (Ax) has made the following choices:

(same options as in the other two treatments)

"You are the participant Ax (Ay). According to your opinion, what is the probability (expressed in percentage terms) that AO (the participant coming from another group) has made the following choices:

(same options as in the other two treatments)

Question for the AO members

"You are the participant AO. According to your opinion, what is the probability (expressed in percentage terms) that Ay (Ax) has made the following choices:

(same options as in the other two treatments)

2. Second Order Empirical Expectations (SOEE)

Questions for the Ax and Ay members

"You are the participant Ax (Ay). Now we ask you to assign a probability (expressed in percentage terms) to each of these hypotheses regarding the probabilities assigned to your choice by participant Ay(Ax).

(same options as in the other two treatments)

"You are the participant Ax (Ay). Now we ask you to assign a probability (expressed in percentage terms) to each of these hypotheses regarding the probabilities assigned to your choice by participant AO (the participant coming from another group):

(same options as in the other two treatments)

Question for the AO members

"You are the participant AO. Now we ask you to assign a probability (expressed in percentage terms) to each of these hypotheses regarding the probabilities assigned to your choice by participant Ax (Ay):

(same options as in the other two treatments)

3 First Order Normative Expectations (FONE)

Questions for the Ax, Ay and AO members

"Think of a generic participant A who is still in her/his original group. What is the right number of tokens that s/he should ask for? **(FONE1)**

(same options as in the other two treatments)

"Think of a generic participant A who is in a group which is not her/his original one. What is the right amount of tokens that she/he should ask for? **(FONE2)**

(same options as in the other two treatments)

4 Second Order Normative Expectations (SONE)

Questions for the AO members

"Think of a generic participant A who is still in her/his original group . What do you think is her/his opinion with regard to the right number of tokens that a participant A who is still in her/his original group should ask for ?"
(SONE1)

(same options as in the other two treatments)

"Think of a generic participant A who is still in her/his original group . What do you think is her/ his opinion with regard to the right number of tokens that a participant A who is not in her/his original group should ask for ?"

(SONE2)
(same options as in the other two treatments)

Questions for the Ax and Ay members

Think of a participant A who is still in her/his original group . What do you think is her/his opinion with regard to the right number of tokens that a participant A who is still in her/his original group should ask for ?
(SONE3)

(same options as in the other two treatments)

Think of a participant A who is still in her/his original group . What do you think is her/his opinion with regard to the right number of tokens that a participant A who is not in her/his original group should ask for ?
(SONE4)
(same options as in the other two treatments)

"Think of a participant A who is not in her/his original group . What do you think is her/his opinion of the other participant A with regard to the right number of tokens that a participant A who is still in her/his original group should ask for ?"
(SONE5)

(same options as in the other two treatments)

Think of a participant A who is not in her/his original group . What do you think is her/his opinion of the other participant A with regard to the right number of tokens that a participant A who is not in her/his original group should ask for ?
(SONE6)
(same options as in the other two treatments)

Subjects were paid only for the accuracy of their guesses in FOEE and SOEE questions according the Quadratic Scoring Rule (Davis and Holt, 1993).

When we detect the relation between subjects' choices and beliefs, we consider only first order expectations (both empirical and normative). This is due to a preliminary analysis on beliefs. First of all, we analyse FOEE and SOEE. In particular, we want to check whether what people think the other has done was in line with what they think the others expected s/he has done. We find out that there is no difference between FOEE and SOEE in all the

treatments ($p < 0.06$, Fisher-exact test in the BT; $p > 0.45$, Wilcoxon test in the AT; $p > 0.15$, Wilcoxon test in the OT).[12]

Then, we check whether this is true also when considering normative expectations. In the BT, it turns out that FONE and SONE are not significantly different ($p = 0.000$, Fisher-exact test). In the AT, FONE are slightly lower than SONE ($p = 0.09$, Wilcoxon test), but highly correlated ($p = 0.0002$, Spearman correlation test). In the OT the analysis is a bit more complicated. This is due to the fact that we have two different kinds of active players – the outsiders and the insiders. Consequently, normative beliefs concern both a generic insider and a generic outsider rather than a generic player A – as in the BT and in the AT. This increases the number of normative expectations (FONE1, FONE2, SONE1, SONE2, SONE3, SONE4, SONE5 and SONE6) and the number of possible comparisons. With respect to the outsiders, we compare FONE1 with SONE1 and FONE2 with SONE2. As a results, FONE1 and SONE1 are not significantly different ($p = 0.34$, Wilcoxon test), while FONE2 are slightly lower than SONE2 ($p = 0.05$, Wilcoxon test). However, when we compare SONE2 with choices, it turns out that they are not significantly correlated ($p = 0.41$, Spearman correlation test). Concerning the insiders, we compare FONE1 with SONE2 and SONE5, as well as FONE2 with SONE4 and with SONE6. In all cases it emerges that they are not significantly different ($p > 0.31$, Wilcoxon test). Finally, we check whether players think that a normative choice does not depend on the role (outsider vs insider). We compare FONE1 with FONE2 and we found out that they are not significantly different according both the outsiders ($p = 0.34$, Wilcoxon test) and the insiders ($p = 0.19$, Wilcoxon test).

To sum up, we find that second order expectations are generally in line with first order expectations. This allows to study the relation between choices and beliefs by taking only first order expectations into account.

[12] We want to point out that when running tests, independence of observations is taken into account. In particular, in the BT each player's observation is independent with respect to all the other players' observations. In the AT, independent observations are group's average observations. In the OT, insiders' independent observations are again group's average observations, while outsiders' independent observations are the average observations of the interchanged outsiders.

Appendix 2 – The Econometric Analysis[13]

$$FOEE\_20_i = AT_i\alpha + Age_i\beta_1 + TENT_i\beta_2 + FIRST * AT_i\delta_1 + \varepsilon_{i1} \quad \text{(R1)}$$

(R1) is a probit regression we implement to explore what kind of variables influence subjects' probability of expecting the others have chosen 20. The dependent variable is the dichotomous variable FOEE_20 that is equal to 1 if a subject expects the others have chosen 20. The control variables are both related to the nature of the experiment (AT, FIRST*AT, TENT) and demographic (AGE). We exclude the variable GENDER since it turns out that in the first two treatments GENDER and AGE are significantly correlated (Pearson coefficient; $p < 0.01$) – women are significantly older than men (ttest; $p = 0.002$). AT is a dummy equal to 1 if the AT is played. TENT is the number of rounds the group voted before reaching a unanimous decision on the rule to be used – variable equal to 0 when the BT is played. FIRST*AT is an interaction term equal to 0 either when the BT is played or when the player in the AT participated in other experiments in the past.

Probit Model – R1

Variables	*FOEE_20*	*Marginal Effects*
AT	-2.1***	-0.58
	(0.478)	
FIRST*AT	-1.29***	-0.47
	(0.453)	
AGE	-0.10	-0.03
	(0.073)	
TENT	0.39**	0.13
	(0.169)	
Constant	3.77***	
	(1.643)	

N	96
Log Likelihood	-39891664
LR chi2(4)	42.43
Prob > chi2	0.000

*****significance 1%**

**** significance 5%**

[13] Multicollinearity – a usual problem of probit regressions – has been detected through VIF tests.

From (R1) it turns out that subjects are more likely to expect a selfish behaviour of the co-players in the BT. Moreover, it emerges that in the AT the higher the number of rounds the group voted before reaching a unanimous decision on the rule to be used the higher is the probability for the subjects to expect a selfish behaviour of the co-players. Finally, in the AT, a player who never participated in other experiments in the past has a higher probability of asking a sum different from 20.

$$FOEE\_20_i = AT_i\alpha + FIRST * AT_i\beta_1 + TENT_i\beta_2 + AGE_i\beta_3 + \varepsilon_{i1}$$
$$CHOICE\_20_i = FOEE\_20_i\delta_1 + FIRST * AT_i\beta_4 + AGE_i\beta_5 + \varepsilon_{i2} \quad \text{(R2)}$$

(R2) is a bivariate recursive probit regression[14] where *CHOICE_20* is equal to 1 if subject *i* chooses 20 tokens. It allows to check: 1) the relation existing among agreement, beliefs and choices; 2) whether there exists any latent variable that may influence beliefs and choice at the same time.

Bivariate Recursive Probit Model – R2

Variables	***FOEE_20***	***CHOICE_20***
AT	-2.87***	
	(0.57)	
FIRST*AT	-1.4***	-0.04
	(0.422)	(0.433)
AGE	-0.15*	0.11
	(0.085)	(0.095)
TENT	0.40**	
	(0.168)	
FOEE_20		2.42***
		(0.712)
Constant	8.16***	-4.38*
	(2.3)	(2.365)

N	96
Log Likelihood	-73.623096
Rho	0.287
Prob > chi2	0.47

*****significance 1% ** significance 5% * significance 10%**

[14] A variation of the analysis run by Di Novi (2007).

From (R2) it turns out that the agreement influences empirical expectations and that empirical expectations influence subjects' decisions. Moreover, as rho is not significantly different from 0, we can affirm that there is no latent variable that may influence beliefs and choice at the same time.

$$EQFOEE_i = OT_i\omega + TENT_i\phi_1 + FIRST_i\phi_2 + \nu_{i1} \quad \text{(R3)}$$

(R3) is a probit regression we implement to explore what kind of variables influence subjects' probability of expecting the others have chosen the voted rule. The dependent variable is the dichotomous variable EQFOEE that is equal to 1 if a subject expects the others have chosen the voted rule. The control variables are all related to the nature of the experiment (FIRST and TENT). We exclude all demographic variables because there is no significant difference due to gender (chi2; $p = 0.97$) and the variables AGE and first are significantly correlated (Pearson coefficient; $p < 0.05$).

Probit Model - R3

Variables	***EQFOEE***	***Marginal Effects***
OT	-0.48**	-0.18
	(0.242)	
FIRST	0.32	0.118
	(0.247)	
TENT	-0.09	-0.03
	(0.069)	
Constant	0.01	
	(0.253)	

N	120
Log Likelihood	-74.073703
LR chi2(3)	8.44
Prob > chi2	0.0539

**** significance 5%**

From (R3) it turns out that subjects are more likely to expect compliance of the co-players in the AT.

$$EQFOEE_i = OT_i\omega + TENT_{i1}\phi_1 + FIRST_{i1}\phi_2 + v_{i1}$$
$$EQCHOICE_i = EQFOEE_i\delta_2 + AGE_i\phi_3 + v_{i2}$$

(R4)

As in the comparison between the BT and the AT, we compare the AT and the OT by running a bivariate recursive probit (R4) where EQCHOICE is equal to 1 if choice corresponds to the voted rule.

Bivariate Recursive Probit Model – R4

Variables	*EQFOEE*	*EQCHOICE*
OT	-0.47**	
	(0.243)	
FIRST	0.40	
	(0.27)	
AGE		0.05
		(0.057)
TENT	-0.07	
	(0.092)	
EQFOEE		2.39***
		(0.945)
Constant	-0.09	-2.065
	(0.342)	(1.284)

N	120
Log Likelihood	-133.37077
Rho	-0.51
Prob > chi2	0.579

*****significance 1%**

**** significance 5%**

From (R4) it turns out that the introduction of the mixed protocol influences empirical expectations and that empirical expectations influence subjects' decisions. Moreover, as rho is not significantly different from 0, we can affirm that there is no latent variable that may influence beliefs and choice at the same time.

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